THE NATURE CONSERVANCY NEWS

January/February 1984

COSTA RICA

Dressed for success?

Donald R. Perry

Only as long as the rain forest lasts.

Give to the General Fund.

THE NATURE CONSERVANCY NEWS

VOLUME 34, NUMBER 1
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COVER: Microcosm, Monteverde Cloud Forest Preserve. The orchid pictured here is *Cattleya skinneri*, the national flower of Costa Rica. Photo by Thomas Blagden, Jr.

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The Nature Conservancy

The Nature Conservancy is a national conservation organization committed to the preservation of natural diversity by protecting lands and waters supporting the best examples of all elements of our natural world.

To date the Conservancy and its members have been responsible for the preservation of 2,075,324 acres of forests, marshes, prairies, mountains, deserts, and islands: home to rare and endangered species of wildlife and plants. 3,238 projects have been completed since the acquisition of the first preserve in 1954. Approximately 60% of all preserves are retained by the Conservancy and managed by staff and volunteer land stewards.

A nonprofit membership organization, the Conservancy was incorporated in 1951 in the District of Columbia for scientific and educational purposes.

A copy of the last financial report filed with the Department of State may be obtained by writing to: New York State, Department of State, Office of Charities Registration, Albany, New York 12231, *or* The Nature Conservancy, 1800 North Kent Street, Arlington, Virginia 22209.

A Model for Conservation

Ken Miyata

by Spencer Beebe, Vice President Director, International Program

WHY COSTA RICA? Because it is a country that does what it says it is going to do. The people said they wanted peace, so they eliminated the army in 1949. They said they wanted education. Now the country's literacy rate is 91 percent—the highest in the Americas. Recently they said they needed austerity. Families and friends got together. They sold what they did not need and restricted themselves to one car, one house, no televisions. They began taking the bus to work.

Costa Ricans also said they wanted natural lands and natural resources safeguarded for the long haul. So, only 12 years ago, they began creating a national network of parks, wildlife refuges, national monuments, archaeological sites, and forest reserves. It now encompasses some 25 percent of the country—a total of almost three million acres. The Costa Rican government has spent many tens of millions of dollars from its own modest public treasury for its national parks and biological reserves alone; they now cover 8 percent of the national landscape: one million acres.

Costa Rica is a biogeographical land bridge in the Isthmus of the Americas, a topographically diverse country where the flora and fauna of North and South America meet. It is also a bridge in another sense, for it serves as a place where northern and southern cultures and political beliefs can meet, where we can more easily learn about the hopes and aspirations of our neighbors. Amidst the turmoil of recent events in Central America, Costa Rica remains an island of stability.

Despite a global economic recession, which has struck Costa Rica particularly hard, President Luis Alberto Monge continues to support his country's conservation endeavors. "Striving, as we are, toward the resolution of a severe economic crisis requiring short-term action, we run the risk of losing the long-term view of the Costa Rica we are going to bequeath to future generations. . . . This we must avoid at all costs."

President Monge serves as chairman of the Campaign for Costa Rica National Parks, developed by the Costa Rica National Parks Foundation, a nonprofit conservation organization. The goals of the $5.5-million, five-year campaign are to acquire remaining private lands still unpro-

Thomas Blagden, Jr.

Northwestern Costa Rica's Monteverde Preserve, some 8,000 acres owned by the Tropical Science Center. The World Wildlife Fund-U.S., The Nature Conservancy, Rare Animal Relief Effort, and other conservation groups funded its creation. Inset: Hyla uranochroa, *one of Costa Rica's many showy frogs, at Monteverde.*

tected within the parks and reserves and to preserve habitat for every species of Costa Rica's flora and fauna. As far as we know, it is the first effort of its kind in the world. The Nature Conservancy's International Program, World Wildlife Fund-U.S., and other conservation organizations are working with the National Parks Foundation on this unique conservation venture.

Thomas Blagden, Jr.

Above: male resplendent quetzal. This endangered New World bird migrates altitudinally half the year to feed on ripe fruits of the avocado family. At right: author Beebe and olive ridley sea turtle, eye to eye in Costa Rica's Santa Rosa National Park.

THE INTERNATIONAL PROGRAM has grown significantly in the past three years. Although the Conservancy's commitment to conservation beyond our borders still involves less than 4 percent of its total human and financial resources—and will certainly remain modest in the foreseeable future—we now have almost 20 full-time staff members (in the U.S. and abroad) pursuing cooperative programs in 12 Latin American countries. In 1984, we will seek a total of over $5 million to fund the International Program's activities in Latin America and the operating expenses of its headquarters in Washington, D.C.

The program's "Think Global, Act Local" approach, one consistent with the Conservancy's earliest beginnings in 1917, seems to be working. Having identified areas of conservation concern on a global basis, we have focused on Latin America—especially those countries where biological stakes are high and tangible results appear to be promising.

Our objective abroad is precisely the same as it always has been at home: preserving Earth's full range of biological diversity. Indeed, it can't be done here if it can't be done there, for here and there are all part of the same interdependent biosphere. The principal strategy for achieving that objective is to help create a global system of parks and protected areas just as we are doing in the U.S. But, rather than acquiring land directly, we assist other nations in building national institutions that can carry on the countries' habitat-conservation programs with their own people and resources, in ways only they know.

In some cases, it is necessary to help build new private organizations that will operate much as the Conservancy does—with national boards and well-trained professional staff members who work with governments, businesses, universities, and scien-

Russell Van Herik

Daniel H. Janzen

Thomas Blagden, Jr.

Wolfgang Bayer

Top: half-grown sibling caterpillars (Arsenura armida) *aligned in characteristic "resting" formation on their host plant. Above: fern close-up, Costa Rican cloud forest. At right: a backlit band of squirrel monkeys, Costa Rica's smallest simian acrobats.*

tists to identify, protect, and manage ecologically important land. In other cases, we are operating with existing organizations and with government institutions. Countries of immediate interest—besides Costa Rica—include Mexico, Brazil, Colombia, Venezuela, Ecuador, Peru, and Panama. Some Latin American countries already have national systems of parks and protected areas. Venezuela and Chile, for example, have devoted approximately 8 percent each of their lands to conservation. Peru has a park system based on sound scientific research that was done to ensure that the full array of its own extraordinary natural diversity is preserved.

The Conservancy also has helped to develop ongoing conservation data centers (biological inventories similar to the 32 natural heritage programs currently operating in the U.S.) in Puerto Rico, the Netherlands Antilles, Argentina, Costa Rica, and Peru. FUDENA (Foundation for the Defense of Nature) in Venezuela has developed a similar program.

WE HAVE FOUND dedicated conservationists, with objectives much like ours, in every country. Conservation needs are different in countries where most citizens live on and by the land. But, if there is one common need, it is for trained professional staff to help national organizations make the most of their enthusiasm and resources. We have developed a Conservation Fellowship Program designed to share the Conservancy's experiences—from scientific identification of critical elements of natural diversity, to acquisition techniques, fund raising, and organizational planning and management—with our Latin American neighbors.

Because we partake of the same ecological resources, we also share in their conservation. When we reflect that one well-managed tropical reserve in Colombia could safeguard at least as many plant and animal species as exist in all the U.S. preserves the Conservancy has protected to date, our modest efforts to collaborate with our neighbors in conservation seems a worthy cause.

An Interview with Alvaro Ugalde

conducted by Robert Cahn

Mr. Ugalde is executive director of the National Parks Foundation of Costa Rica and director of the Costa Rica National Park Service. Robert Cahn is a Pulitzer Prize-winning author who writes on national park issues.

Q. How did conservation begin in Costa Rica? Was there a particularly influential leader or organization, such as John Muir or the Sierra Club in the United States?

A. Over the past 100 years or more, a number of laws aimed at preserving land or wildlife have been enacted in Costa Rica, although they did not derive from an organized conservation movement or effort. However, until the 1970's, most of the laws were not enforced. For instance, a 1955 law declared any lands within a radius of two kilometers around all the country's volcano craters to be national parks. It also instructed the Costa Rican Institute of Tourism (ICT) to protect these parks—but nothing happened. Moreover, the ICT acquired the historic house and a surrounding 10,000 hectares (24,700 acres) of parkland at Santa Rosa, in the northwestern province of Guanacaste. They designated it as a national monument yet did not restore the house or safeguard the area.

A small forested area at the tip of the Nicoya Peninsula, on the Pacific Ocean, was the first site to receive real protection. It was designated in 1963 by executive decree of Costa Rica's president as the Cabo Blanco Nature Preserve. Olof Wessberg, a Swedish immigrant, had devoted his life to saving what he called, "the most beautiful forest that God has created." He raised $30,000 from private outside sources to buy the land, then served as Cabo Blanco's administrator without pay. In the same year, the endangered sea turtles that nest on the Atlantic beach of Tortuguero were provided protection by executive decree after a U.S. scientist, Dr. Archie Carr, documented their vulnerability. Then in 1969, when a forestry-protection law included a section allowing national parks to be established, the time was right for conservation.

Q. What about the people of Costa Rica—weren't they concerned about what had been happening to their natural resources?

A. Costa Rican citizens have been aware of the importance of our forests, especially our dependence on them as watersheds. We are proud of the country's natural wealth but did not realize its uniqueness or how much of it was being destroyed until we began receiving data from scientists.

With its abundance of species, Costa Rica for many years has been a laboratory for biologists studying tropical forests and their wildlife. Scientists claim that, for its size, the country has more species than any other terrestrial habitat in the world. No larger than West Virginia, it has over 200 species of mammals, 150 of amphibians, 210 of reptiles, about 1,000 of butterflies, 850 bird species (more than in all of the United States and Canada combined), 2,500 species of large and medium-sized trees, and 1,200 species of native orchids.

Q. Haven't U.S. scientists done a great deal of work in Costa Rica and gathered information on the threats to species and land?

A. Yes, very much. In addition to people like Dr. Carr and Dr. Daniel Janzen of the University of Pennsylvania—who have carried on important studies in Costa Rica—Dr. Joseph Tosi and Dr.

Susan Bournique

For their collaboration in building Costa Rica's National Park Service, Sr. Ugalde (foreground) and Mario Andres Boza received the J. Paul Getty Wildlife Conservation Prize at a White House ceremony last July.

Leslie Holdridge made a great contribution in 1952 by forming the Tropical Science Center in San José to support scientific research and education. Also, the Organization of Tropical Studies, a consortium of universities in the United States and Costa Rica, sponsors studies in tropical biology and operates several research and training stations in Costa Rica.

Q. With no strong conservation movement, how did Costa Rica's national park system come to be and to evolve, in just over a decade, into a model for all developing countries?

A. Costa Rica has long had all the necessary ingredients for a national park movement. We have a politically stable society and a true democracy in which all citizens are deeply involved in the political process. By doing without an army, navy, or air force, we can allocate more of our scarce resources to education, health services, housing, *and* conservation. And we have a mostly middle-class society.

It is a country of complete freedom of thought and speech, where public opinion weighs heavily on the government's actions and citizens have easy access to political figures. Costa Rica also has a population of only 2.3 million. Its decision-making process is still very centralized, and regional governments have been willing to cooperate with the central government.

Another important element has been our willingness to accept from other nations ideas that may help us in solving our problems—such as the U.S.-originated national park concept—if the ideas agree with our own principles and needs. Finally, all of us feel related to the countryside in some way and, until recent years, we could see the forests everywhere and enjoy clean rivers and abundant wildlife.

But by the 1960's, almost 50 percent of our natural forests had been destroyed by logging and agricultural development. There were fewer and fewer forests, less water, fewer animals, and—during the dry months—more and more bush fires

on the horizon. To that scenario, introduce some characters who were convinced of the need to take action at whatever cost, and we have the situation that resulted in the present national park system.

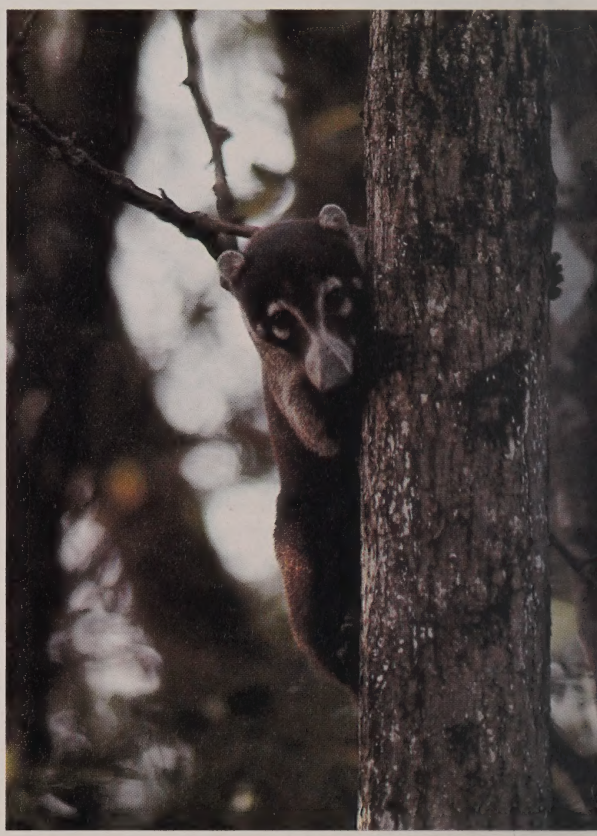
Q. You are really referring to Mario Boza and yourself, aren't you?
A. Yes, but we must not forget others who have been part of the cast since 1970 and those who promoted the writing and approval of the 1969 Forestry Law, which created the roles that first Mario and, shortly after, both of us would play. Mario fell in love with the national park idea when, at the age of 27, he visited the Great Smoky Mountains National Park on a 1968 United States study tour conducted by Dr. Kenton Miller. Mario was so inspired that he wrote the master plan for Poás Volcano National Park as his master's degree thesis.

That same year, when I was 22, I met Mario at a conservation meeting. A few months later, while he was working for the Forestry Directorate as the only person in the National Parks Department, he asked me if I would go to the United States for a month-long international training course in national-park management—if he could raise the money. He raised it, and I took the course, then stayed for another course in U.S. national parks operations at Grand Canyon National Park. In December of 1969, when I returned to Costa Rica, Mario made me an unpaid employee. He asked me to go to Santa Rosa and take over the management of what we hoped would be Costa Rica's first real national park. Under the Forestry Law, Mario had taken control of the Santa Rosa National Monument and the Cabo Blanco Nature Reserve.

Kenton Miller and a U.S. Peace Corps volunteer had studied the Santa Rosa area in the late 1960's and ascertained it to be of national park quality. When I arrived, I found more than 40 families of squatters occupying the property and burning acres of forests for farming. With the help of newspapers, the National Association of Biologists, the National Youth Movement, and civic groups, we took control of Santa Rosa, relocated the squatters, and improved the historic building.

Q. Didn't you then run into some political problems?
A. Yes, the President of Costa Rica's Legislative Assembly, Daniel Oduber, sponsored a bill to turn Santa Rosa back to the Institute of Tourism. But Mario and I appealed to Karen Olsen Figueres, the American-born wife of President José Figueres, to help us. We had met her on a trip to see the turtle research station at Tortuguero, and one of their sons had worked with me when I was helping Dr. Carr to band sea turtles. Doña Karen personally lobbied every member of the Assembly, and the bill was defeated. Then she persuaded President Figueres to issue an executive decree establishing Santa Rosa as a national park.

With our conservation allies, Mario and I had worked to get the Legislative Assembly to enlarge Poás Volcano National Park beyond the crater's rim. After I had been put on the Park Service's payroll and worked as superintendent of Santa Rosa National Park for three years, I was sent to Poás as superintendent. We were able to add a few employees and the National Park Service got



Joe & Sheila Leonard

started. It had little funding and was still under the Forestry Directorate (within the Ministry of Agriculture) but was gaining public support, credibility, and authority.

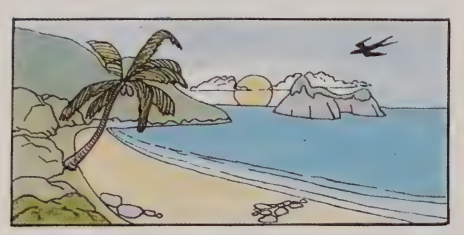
With the help of the media, conservation-oriented citizen groups, the First Lady, and our colleagues in the Park Service, Mario and I had two national parks established by law and four others by presidential decree—2.5 percent of the country's land. We also had a budget of about 5 million colones (then about $600,000) and 100 employees in the Park Service by the end of the Figueres Administration.

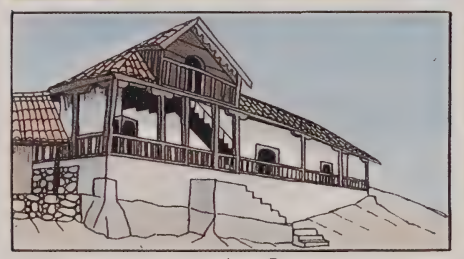
Loren McIntyre

Opposite: coatimundi, a forest-dwelling raccoon relative, at Santa Rosa National Park. Above: Poás Volcano National Park, established in 1971. Its semi-opaque crater lake changes color with volcanic activity.

¿Qué es un Parque Nacional?

Aquellas regiones o áreas de significación historica, que por sus bellezas escénicas naturales, su geomorfolgía o presencia de ecosistemas no alterados o flora y fauna importantes son protegidas y administradas por el Servicio de Parques Nacionales.





Los Parques traen beneficios al poder ser usados para la recreación y el turismo, la investigación y la protección de las cuencas de los ríos.

Costa Rica National Park Service poster: "What is a national park? Those regions or areas of historic significance, which because of their natural scenic beauty, geomorphology, unaltered ecosystems, or important flora and fauna are protected and administered by the National Park Service. Benefits of the parks include use for recreation and tourism, scientific investigation, and protection of headwaters of rivers."

Q. What happened to Costa Rica's national park system when a new administration took over in 1974?

A. We feared the worst, because the new president was Daniel Oduber, with whom we had tangled in 1970 over Santa Rosa. We also ran into difficulties when Mario's attempt to transfer the National Park Service out of the uncooperative Ministry of Agriculture was blocked by the new agriculture minister. Mario was about to lose his job as head of the Park Service and be transferred, so he resigned and began a school of environmental sciences at The National University of Costa Rica. I was then appointed director of the National Park Service, a position I still hold.

But to our surprise, President Oduber turned out to have a great appreciation of the national parks. The Park Service became a full directorate, equal to the Forestry Directorate, the parks budget tripled, and we increased our staff to nearly 400. We also added Corcovado and Chirripó National Parks, as well as other areas, and purchased a good deal of the private land within our parks. All together, another 2 percent of the country was added to the national park system.

Q. What has happened since Oduber left in 1978?

A. Mario Boza became natural resources advisor to the new president, Rodrigo Carazo. President Carazo signed executive decrees establishing Coco's Island, Palo Verde, and La Amistad National Parks. But he was not as great a supporter of the parks as Daniel Oduber and did not provide the resources needed to manage the areas. When he issued a decree substantially reducing the boundary of one of the parks, Mario resigned. With the Association for the Conservation of Nature (ASCONA), Mario initiated a court challenge under the 1969 Forestry Law specifying that once national parks were decreed, they could not be eliminated except by action of the Legislative Assembly. The courts have not yet ruled on the challenge. The Assembly, however, has passed a law authorizing as national parks all the areas previously designated only by presidential decrees.

Q. During these last 12 years, when the national park system has bloomed, have people become more aware of conservation and the need to protect wildlife and habitats?

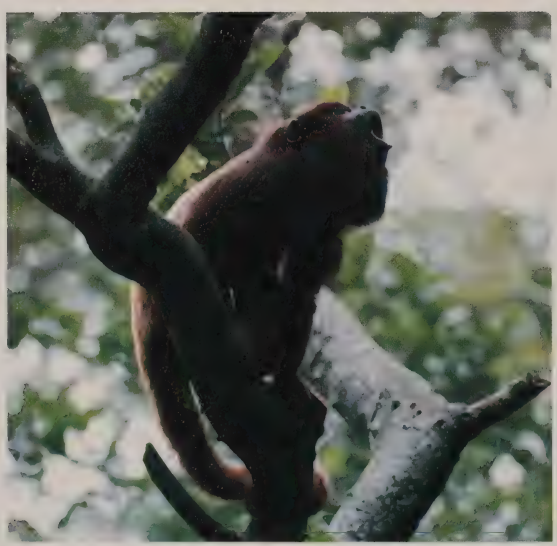
A. The parks have become the backbone of a con-

Joan Pennington

THE NATIONAL PARKS OF COSTA RICA

Joe & Sheila Leonard

Wolfgang Bayer



Top: La Amistad, Costa Rica's largest park, abuts the second largest park (Chirripó, pictured at right) in the Talamanca Mountains. Above: the endangered howler monkey.

servation movement. Some of them are used by a great many Costa Ricans, and even the people who have not yet visited the parks take pride in them and want them protected.

Mario, who is now at the Open University in San José, has developed an environmental education program that is helping to increase the general public's awareness of conservation. Citizens are now quick to protest any harm to the forests, wetlands, and other habitats. It is still a battle to avert commercial and agricultural development, especially during the past four or five years when the Costa Rican economy has been greatly stressed.

Q. What is the National Parks Foundation and how did it originate?

A. When the economic recession intensified, Mario and I decided the national parks would need private financial help because we could not expect a hard-pressed government with many other priorities to give us all the funds required. So in 1978, we created the National Parks Foundation

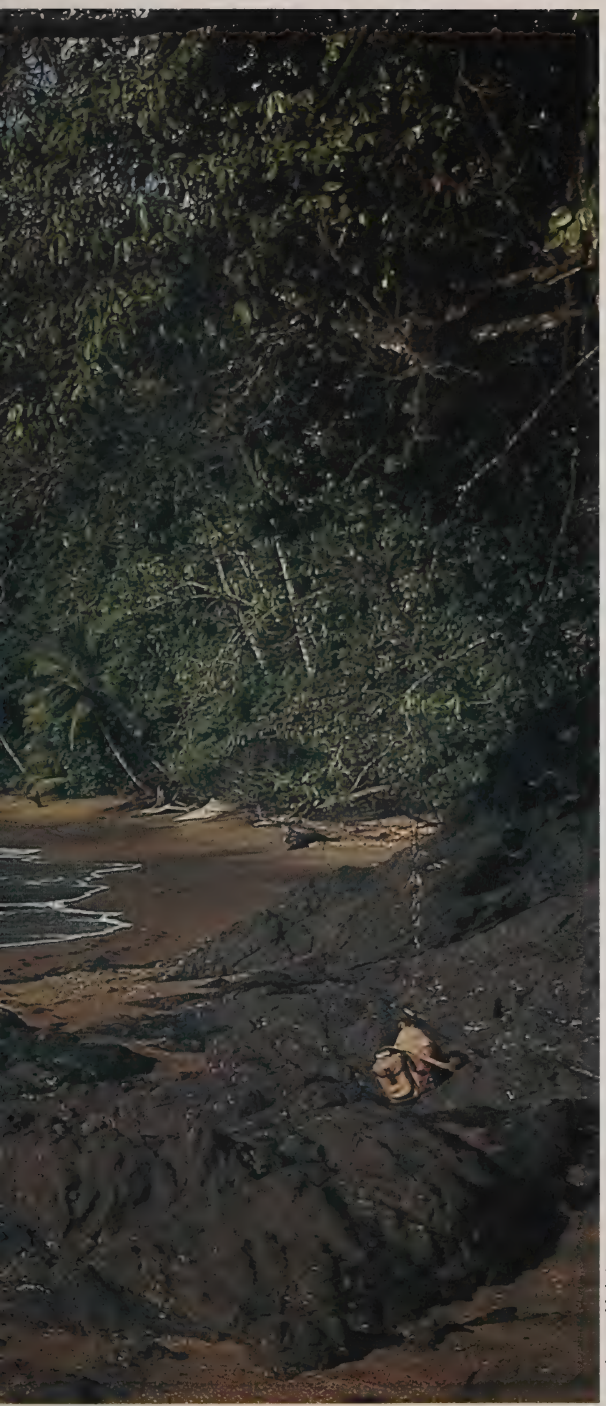
and in 1982 obtained "seed money" from World Wildlife Fund-U.S. and The Nature Conservancy. We use the Conservancy's International Office in Washington, D.C., as our U.S. operating base. The Foundation's purpose is to develop and carry out a program to protect Costa Rica's biological diversity through an integrated system of natural areas, parks, refuges, and biological reserves.

Our national park system now includes 22 units in the form of national parks, monuments, and biological and nature reserves encompassing 8 percent of the nation's land. Yet 20 percent of the land within the park system remains in private ownership and must be purchased. So we (the Foundation) have started a five-year campaign in cooperation with the Costa Rican government to raise the estimated $5.5 million needed for land acquisition. We also want to complete the preservation of samples of major ecosystems, help to develop and improve the management and protection of the national parks and equivalent reserves, and create a system of protected small natural areas that will preserve each and every species.

Below: the Jesus Christ (basilisk) lizard, which "walks" on water—sprinting on the long toes of its hind legs in a circus of splashes. Bottom: mist and oaks, Chirripó.

Cathy Pringle

Phillip Vaughan



Loren McIntyre

Palm-fringed beach, Corcovado National Park.

Q. What is the Costa Rican Natural Heritage Program?
A. In partnership with The Nature Conservancy and the National Museum of Costa Rica, we are endeavoring to accomplish the same things that the Conservancy has done so well in the United States: identifying the country's most threatened unprotected species, plant communities, and other critical natural features and recommending the best methods to ensure their permanent protection. We will concentrate on the endangered species and habitats in the greatest need of preservation. The Conservancy secured a generous grant from the General Services Foundation that—combined with the Conservancy's "know-how"—got the program started. But more funding and staff are needed to continue its work.

Q. Why are you doing most of your fund raising outside Costa Rica, especially in the United States?
A. In spite of the country's present economic situation, we are receiving donations from Costa Ricans, and we hope to receive still more. But since we cannot depend solely on the citizens and government of Costa Rica to provide the entire $5.5 million, we decided to seek help in other countries. We chose to begin in the United States because our countries have strong political ties, Costa Rican habitats are necessary for the survival of many of your migrating bird species, and Costa Rica is the training ground for many American tropical biologists. Our country, with its biological diversity and political stability, has enabled U.S. universities to establish research stations and to rest assured the stations will not be affected by roads, agriculture, or commercial development. Also, it was in the United States that Mario and I first learned about national parks. The U.S. Park Service, several U.S. conservation organizations, and hundreds of U.S. citizens have given us advice. It was only logical to ask our American friends for their support. But there is an even more significant reason for fund raising in the United States: the flora and fauna that are saved in Costa Rica may play a vital role in providing the food and pharmaceutical supplies of the future—for both Costa Ricans *and* Americans.

Costa Rica's Endangered Felines

by Christopher Vaughan

THE LARGEST CAT of the New World, the jaguar was revered as a powerful and savage god by pre-Columbian civilizations; its image has been found decorating pottery, temples, and cave walls. Less than 150 years ago, it roamed California and possibly Louisiana and occurred as far north as the Grand Canyon. Today, because of overhunting and habitat destruction, the elusive creature exists only in undisturbed areas from northern Mexico down through Central America, and east of the Andes to the northern tip of Argentina. It prefers tropical and subtropical forests but also has been reported in mangrove, scrub thickets, and swamps—even in open woodland.

A large male jaguar, king of neotropical jungles, may be seven feet long, with its tail making up about a third of that length. Some 25 inches high at the shoulder, the cats vary in weight from an average 122 pounds (for eight males found in Mexico) to a record 356 pounds (for a male taken in Brazil). Females are generally smaller.

Jaguar diets include peccaries, deer, pacas, monkeys, sloths, iguanas, caiman, turtles, and capybaras (the world's largest rodents). An adept swimmer, the jaguar also pursues its prey in water and sometimes beaches large fish by waiting on riverbanks and slapping them from the water with its huge paws.

Using radio telemetry, the well-known naturalist George Schaller studied the jaguar in Brazil. He found that its social organization is very similar to that of other large solitary cats, such as leopards and tigers: males occupy home ranges (between 19 and 26 square miles in size) that overlap with those of several females. Presumably, they associate with the females only during the mating season.

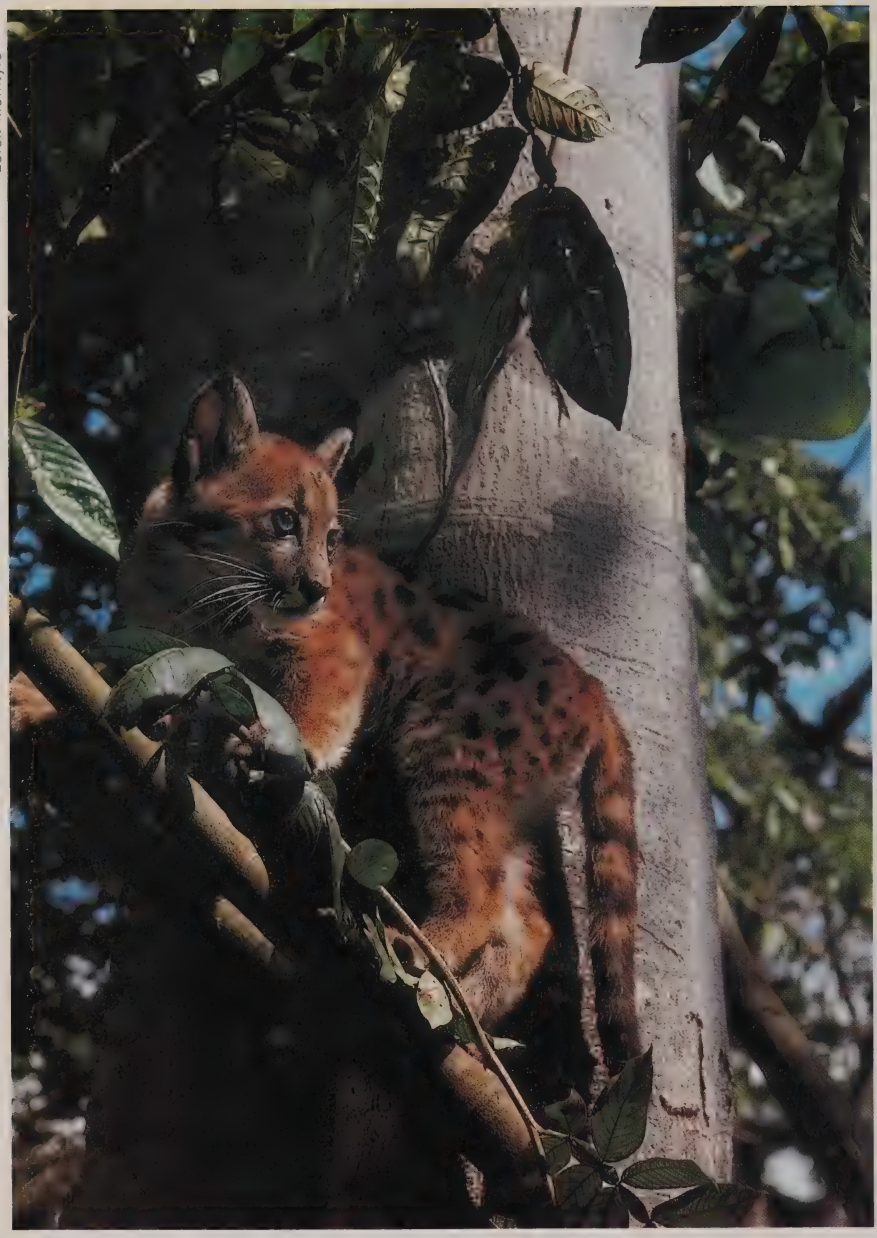
Studies of jaguars in captivity indicate that one to four young are born at any time of the year; gestation periods vary from 93 to 105 days. Following birth, the mother remains with the cubs and may change shelters if the least disturbed. About six weeks later, her offspring begin following her in hunting expeditions; they remain hidden in thick vegetation. At nine to ten months of age, the cubs are half-grown—they probably remain with their mother until she is ready to give birth again. A jaguar is considered mature when it is three years old.

SIX WILD FELINE SPECIES, including the jaguar (*Felis onca*), are found in Costa Rica and in most tropical Latin American countries. The others are the ocelot, the margay, the puma, the jaguaroundi, and the little spotted or tiger cat. All four spotted cats (jaguar, ocelot, margay, and little spotted cat) are classified as vulnerable throughout their ranges by the International Union for Conservation of Nature and Natural Resources (IUCN). The jaguaroundi is of "indeterminate status," according to IUCN—although the U.S. Fish and Wildlife Service lists it, and the Costa Rican puma, as endangered in Costa Rica, Panama, and Nicaragua.

The ocelot (*Felis pardalis*) is the best known of Costa Rica's small to medium-sized felines. Found from the southern tip of Texas to Paraguay and northern Argentina, it varies greatly in coat pattern, color, and size throughout its range. Males average about 29 pounds in weight and about 45 inches in length. Although its choice of habitat is similar to that of the jaguar, the ocelot is considered more adaptable: at times it lives in second-growth woodland, near towns, and in abandoned fields. It

C. Allan Morgan

The jaguar—king of the neotropical jungles and one of Costa Rica's six wild feline species.



Loren McIntyre

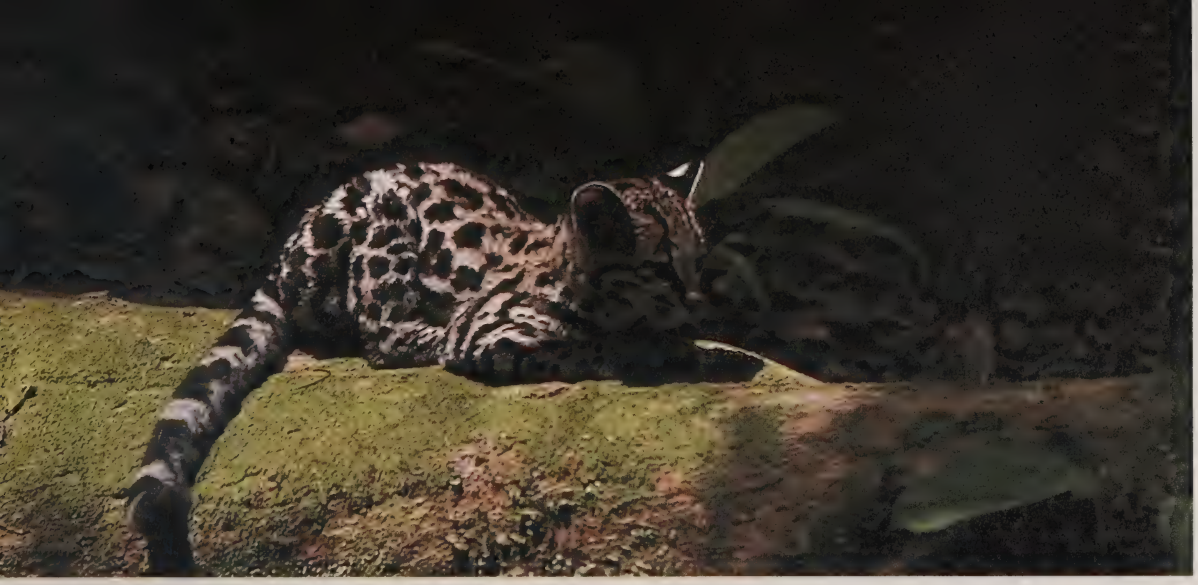
Daniel H. Janzen

C. Allan Morgan

is principally nocturnal and seeks daytime resting sites in tree hollows, branches, or caves. It feeds mostly on rodents and reptiles. The ocelot hunts primarily on the ground, but it is also an excellent climber and occasionally searches for prey in trees.

The margay (*Felis wiedii*) is perhaps the rarest of the wild felines in Costa Rica. Because of physical similarities, it is sometimes called the little ocelot. No ecological studies of this species have been carried out, so what little information exists is based on few observations. Occurring from Mexico to northern Argentina, the margay is believed to be principally arboreal and nocturnal, inhabiting heavily forested areas. It preys on small birds, frogs, lizards, mice, and rats. Almost nothing is known about the natural history of the little spotted cat (*Felis tigrina*), which is found from central Costa Rica to Brazil. Males average the size of a hefty domestic cat.

The four spotted cat species have been greatly affected by commercial hunting throughout Latin America. In Costa Rica, one ocelot pelt was worth six months' salary to a field worker, and many rural Costa Ricans earned or supplemented their living by hunting spotted cats. However, since its creation in 1973, the Convention on International Trade in Endangered Species (CITES) has stopped much of the traffic in these species or their hides.



Far left: young puma, still blue-eyed and spotty. (Camouflage coats safeguard some mammals in infancy.) Above: the margay, sometimes called "little ocelot" because of its resemblance to that species, is perhaps the rarest of Costa Rica's six endangered cats. At left: jaguaroundi.

(Currently ratified by 82 countries, CITES provides a complex mechanism for regulating trade in endangered and threatened plants and animals, including their by-products.)

Costa Rica was one of the first countries to ratify this important international treaty, in September 1975. Because many of the world's largest importers of Latin American spotted feline furs (nations such as the United States, Italy, France, West Germany, and Japan) participate in CITES, trade in any of Costa Rica's spotted cats is illegal. All six of the country's endangered cats are protected locally by a wildlife law that prohibits capturing or killing them. It is also illegal to maintain any of these animals in captivity, except in a zoological park. In the last five years, Costa Rica's Wildlife Department has confiscated numerous skins and live cats in an effort to enforce the regulations. Today, there is no public dealing in hides or live animals; only a few years ago, furs were bartered openly in market places and leather shops, and live ocelots were sold by newspaper advertisements. People found guilty of killing or skinning a wild feline now receive jail sentences or stiff fines or both, and their firearms are confiscated. Nonetheless, studies are needed to determine if these measures are adequately protecting the wild populations.

Although commercial exploitation has significantly affected the native cats of Latin America, habitat destruction is the major threat to many species. Fifty percent of the Earth's tropical rain forests, which embrace extensive portions of the wild felines' ranges, occur in Latin America. The destruction of these forests—owing to logging, fuel-wood gathering, and conversion of land to raise crops and feed cattle—is now calculated at 50 acres a minute, or over 26 million acres a year (half the size of California). At this rate, half of the world's remaining tropical forests will be destroyed in the next two decades. Only legally established and actively protected wilderness areas will remain as habitats for the imperiled cats.

COSTA RICA has established more than 45 protected natural areas to date. These lands are located in a range of ecological zones—from lowland rain forests, through mid-elevation cloud forests, up to high-mountain oak forests and subalpine treeless zones. Most encompass habitat for the country's six wild cat species.

Corcovado National Park on the Osa Peninsula represents the most biologically complex wild region in Costa Rica. The park's more-than-ten vegetational associations vary from a swampy section in the center of the park, which harbors caimans and endangered American crocodiles, to lowland forests that support towering (180-foot) tropical trees. Hilly forested areas surround these lowlands on three sides. More than 350 bird species have been reported within Corcovado's boundaries. Vast regions of the 100,586-acre park—refuge for large herds of white-lipped peccaries—remain unexplored. It is not uncommon to see jaguar tracks, or the animal itself, around the administration center at Corcovado. Because the park encompasses relatively undisturbed rain forest, it and the adjoining Golfo Dulce Forest Reserve probably contain the largest populations of jaguars, and perhaps of other endangered cats, in Costa Rica.

The two largest Costa Rican national parks are 474,240-acre La Amistad and 123,870-acre Chiripó. Adjoining each other, the two sanctuaries lie in the highest and longest mountain range in the country, Talamanca, which extends from central Costa Rica down through Panama. Here, the vegetation is distinct from Corcovado's. Above 8,000 feet in this mountainous area, majestic oak trees form pure stands. The endangered resplendent quetzal finds one of its last refuges in this cloud forest.

Ocelot, temporarily tranquillized by researchers for receipt of a radio collar. Ocelot studies are in progress here in the thorny chaparral region of Texas, in Peruvian rain forests, and on Venezuelan ranches.

La Amistad and Chirripó National Parks, with adjacent forest reserves and other wilderness areas, form the largest expanse of forest in Costa Rica. Several feline species inhabit this region, although probably at lower densities than in the rain forests. The jaguar, puma, ocelot, and the little spotted cat cross over the area's subalpine meadows (found above 10,000 feet), searching for brocket deer, rabbits, porcupines, and other prey.

Only an hour's drive north of San José, Braulio Carrillo is one of Costa Rica's newest national parks. It takes in some 77,560 acres of mid-elevation forest. Characterized by very rugged mountainous terrain, and almost continuous cloud cover and rainfall, many sections of the park are steep and inhospitable. Braulio Carrillo National Park lies adjacent to a larger complex of protected forested areas, including La Selva Biological Reserve. All six of Costa Rica's wild cats are thought to dwell in the park and adjoining lands.

Although each of these areas supports distinct floral and faunal communities integral to the nation's park and wilderness system, scientific information is unavailable to determine if their protection ensures long-term survival for Costa Rica's felines. Using the theory of island biogeography, ecologists have pointed out in recent years that the size and spatial distribution of suitable habitat for a species is critical. Only in a sufficiently large habitat can a minimum number of a species' individuals survive to maintain an evolutionary viable population. (See "What a Species Needs to Survive," by Daniel Simberloff, in the November/December 1983 *News*.) Otherwise it will become extinct in that area. Depending on the species and its habitat needs, this minimum population size varies from fewer than a hundred to several thousand individuals.

For wide-ranging carnivores, such as the wild felines, protected "islands" must be large enough to sustain genetically viable populations. To establish such preserves, we must gain an understanding of the various cats' ecological needs and how humans affect the survival of each species. Some of these species are being studied in other parts of their ranges. For example, the ocelot is the subject of research in the thorny chaparral region of Texas, in the tropical rain forests of Peru, and on Venezuela's cattle ranches. Research on the jaguar in Brazil dates back to 1979, and the puma has been studied intensively in the western United States since the 1960's. Apart from the Peruvian study, no detailed scientific research has been carried out on any of the six cat species in the tropical rain forests. These lush environments, extending from southern Mexico to Bolivia and Brazil, provide over half of the cats' habitat.

MY COLLEAGUES, who are Costa Rican biologists, and I will begin a five-year study in early 1984 on feline ecology focusing, if possible, on *all* of Costa Rica's six cats in La Selva Biological Reserve. This is part of a more extensive research effort to understand carnivore and prey species relationships in the tropical rain forests. La Selva is a 3,500-acre research area adjoining over 370 square miles of similar, mostly undisturbed vegetation. The Organization of American States (OAS), the Organization for Tropical Studies (OTS), The National University of Costa Rica, and the Costa Rican Wildlife Department will fund the first year of our study. Owned and managed by the OTS, a consortium of United States and Costa Rican upper educational institutions, La Selva was identified by the U.S. National Research Council as one of four tropical sites worldwide where long-term ecological studies should be centered.

Field researchers will use radio telemetry for most of the study's initial work at La Selva—trapping individual cats, anesthetizing them, and equipping them with radio collars before their release (after recovery) at the capture sites. The animals will be tracked from the ground, from stations on tree platforms 40-to-50 meters high, or from aircraft.

We will study how and where the cats travel on a daily and yearly basis, how far they range throughout the year, what periods they devote to hunting and resting, and what vegetation types each species prefers. We also hope to determine when they reproduce, how the different cat species interact, what their major prey species are—and how these prey populations fluctuate during the year.

Information gathered from our study (supplemented by data from other cat research) should aid us in determining the basic ecological needs of each cat species found within La Selva and adjacent areas. By meeting these requirements, we may be able to model reserves that offer the animals suitable habitats—and are extensive enough to maintain viable populations. Only by protecting such environments, and managing them with care, can we better the chance that Latin America's wild felines will survive.

Christopher Vaughan is professor of wildlife biology and mammalogy at the Environmental Sciences School of The National University in Costa Rica. In addition to coordinating the wild felines project at La Selva Biological Reserve, he oversees other research programs on Costa Rica's endangered or economically valuable species. Dr. Vaughan also directs a program to train Costa Rican biologists in wildlife management.

ECOLOGY FORUM

No. 52
by Daniel H. Janzen

COSTA RICAN PARKS: A RESEARCHER'S VIEW

A park whose flora and fauna are unknown and uncataloged can be compared to an excellent library whose books have no titles, no authors, and no call numbers. This is one of the primary reasons why Winnie Hallwachs, a graduate student from Cornell University, and I have been surveying the moths of Costa Rica for the past four years. We estimate that there are some 9,000 moth species in the country, most of them occurring in the national parks and similar permanent reserves—the locations of nearly all of our 23 intensive survey sites.

The moth fauna of these areas is formidably large. By way of illustration, all of North America above Mexico supports about 70 species of the moth family Saturniidae, which includes such large and colorful creatures as cecropia, polyphemus, and luna moths. But, even though Costa Rica is roughly the size of West Virginia, our latest census shows that *its parks* harbor a minimum of 98 species of Saturniidae. Any particular lowland park alone hosts a breeding population of 30 to 45 species, which means that a few hundred square kilometers of Costa Rica's lowlands support as many species of these moths as does all of the United States east of the Mississippi. Meanwhile, members of the family Sphingidae—the sphinx and hawk moths, which use their long tongues to drink nectar from flower blossoms—number 115 species throughout North America north of Mexico; but 130 occur in Costa Rica. In Santa Rosa National Park alone, 108 square kilometers of lowland dry forest harbor about 145 species of the family Notodontidae, while *all* of North America has only 136 species.

By the end of our project—30 years from now—we shall have placed moth specimens from Costa Rica's parks in the major collections of the world and organized, at the Museo Nacional in San José, the *only* identified reference collection yet created for the moths of an entire tropical country. In addition, we shall have published field guides to each of the moth families for Santa Rosa National Park (in Spanish) and for the country as a whole.

All of this taxonomic and geographic referencing will mean that moth caterpillars—the most significant group of leaf-eaters in tropical forests—may for the first time receive the ecological attention they deserve. Moreover, the Costa Rican specimens and the diverse habitats represented by the country's national parks will be internationally useful to the study of tropical moth taxonomy and ecology. We anticipate that this research will also serve as a model and impetus for similar studies of other species-rich groups of Costa Rican organisms.

But why do we personally want to see that the moth fauna of Costa Rican parks is named and identifiable? The bane of tropical researchers is to behold an interesting biological phenomenon involving undescribed, unknown species. One has no reference point, no words to record the organisms that have been observed and no means of relating those observations to the observations of others. Because I am documenting the impact of Santa Rosa's caterpillars on the lives of the park's 680 species of broad-leafed plants, I must be able to identify all of the area's moth species. In addition, I am studying how the traits of the plants influence the caterpillars.

The first step in my research is to discover what species of caterpillars occur and in what numbers. I scrutinize every limb and every bit of foliage. Since green caterpillars are not easily seen on green leaves by daylight, I search for them at night with a flashlight. By artificial light, the insect reflects a shade of green that is different from the green reflected by the leaf. Moths are attracted for observation—and to obtain eggs—by the lights we hang in the forest; and by hanging cages that contain virgin female moths, we can census the males that come to mate—by marking, releasing and re-

capturing them. I also release young caterpillars that have been raised in captivity into the forest (different numbers per tree) to see how many leaves they eat before maturing or being taken by a predator. At the same time, I note how the trees respond to having their foliage eaten.

Numerous questions arise. With so many available plant species, why does a particular caterpillar species feed on only one or a few species of plants? Is it because the uneaten plants grow in the wrong microclimate, contain defensive chemicals that render them inedible, or are too easily gleaned of caterpillars by predators? The answers are different for each species of caterpillar and for each potential host plant.

For example, many saturniid moth caterpillars that feed on a variety of plant species at Santa Rosa are the best protected against vertebrate predators. These hemileucine saturniids have stinging spines —equipment that makes it less necessary for them to conceal themselves visually from predators. They can feed on many more tree species than can caterpillars whose protection depends on camouflage.

The chemistry of host plants also helps determine what foliage different caterpillars eat. Members of certain tropical plant families contain very toxic substances in their leaves. (The caffeine in your coffee is an example of such an ingredient, as are cocaine and nicotine.) Although saturniid caterpillars are relatively indiscriminating in the flora they consume, they are seldom observed eating the poisonous plants at Santa Rosa. The diet of sphingid caterpillars, on the other hand, is composed almost entirely of these toxic plants. We can only conclude that the creatures are very competent at detoxifying or somehow avoiding the poisonous substances.

While pursuing these studies, we live seven months of the year only a few tens of meters away from our work, unless an army ant colony cleans out the house or a boa catches a rat in the ceiling. Santa Rosa's park guards and administrators sleep at the gates, fight the fires, ride hard under the hot sun to deter poachers, and sit for hours in town fretting over legal battles with neighboring landowners. These people safeguard the park and make it possible for us to count beetles, scrutinize caterpillars, and examine tapir dung in peace.

We do, however, share with park officials in introducing Santa Rosa to visiting university students, such as those who come from the Organization for Tropical Studies, the University of Pennsylvania, Sweden's Uppsala University, and The University of Costa Rica. Because we are familiar with the park's biota (and have described it in scientific journals, at conferences, and in general biology books), we can offer visitors a portrait of the area that is richer in detail than one they would view at a different, lesser-known tropical site. We can point out, for example, that a certain guapinol tree is 450 years old because we have eight years' worth of growth records for it. We can explain that agoutis—the rabbit-sized rodents that Winnie Hallwachs is studying—may carry and deposit the guapinol's seeds as far as 100 meters from the tree because we have tracked and watched the animals. We can write captions for the park's dioramas. We can even tell students that there are more than 2,500 caterpillar species in Santa Rosa, and, should a catastrophe strike the park, at least a quarter of these insects will be eventually extirpated from the country as its dry forests are converted to rice fields, cotton patches, and cattle pastures.

Biologists at Santa Rosa cannot serve simultaneously as researchers, park naturalists, and interpretive guides. But the flow of information from researchers to park personnel—and then to park visitors—is undoubtedly the largest local benefit we offer to Santa Rosa. Moreover, we show that it *is* possible to live where you work, even if it's in a forest 250 kilometers from San José. Here we are learning how a fragment of the tropics still functions.

The use of parks and reserves by researchers has made these areas more visible and has increased their importance to those who pay for their continued existence through labor, taxes, and lottery tickets—the people of Costa Rica themselves. Biological researchers and conservationists are greatly in debt to Costa Ricans for their farsightedness in supporting their park system.

Daniel H. Janzen is professor of biology at the University of Pennsylvania and an associate of the Museo Nacional of Costa Rica. He has been conducting research in Costa Rica since 1963 and is the editor of *Costa Rican Natural History* (University of Chicago Press, 1983).

PRESERVE RECEIVES INTERNATIONAL RECOGNITION

The Conservancy's Northern California Coast Range Preserve, a spectacular 4,000-acre wilderness in Mendocino County, has been named an "international biosphere reserve" by the United Nations' Man and the Biosphere Programme. The designation has been given to only 262 natural areas in the world, 40 of them in the United States. The Conservancy's Konza Prairie in Kansas and its Virginia Coast Reserve received the same recognition in 1979.

NEW PROJECTS

CALIFORNIA

Paine Preserve—Addition—(Kern County). A 160-acre purchase enlarges the sanctuary, which is a mosaic of valley saltbush scrub and alkaline vernal pools—two ecosystems targeted for protection by the California Natural Diversity Data Base. Three species endemic to the San Joaquin Valley are found on the preserve: blunt-nosed leopard lizard, San Joaquin kit fox (nationally endangered species), and alkali larkspur. An $87,670 fund-raising goal has been set for the addition within the California Critical Areas Program. The Conservancy's California land steward manages the 360-acre preserve.

IDAHO

Stapp-Soldier Creek Preserve (Camas County). A gift from Mrs. Catherine Stapp, the new 100-acre sanctuary bears cottonwood/aspen riparian habitat, a high quality wet meadow, and a hillside of native grasses and forbs. The creek harbors a fish species of special concern in the state, the Wood River sculpin, found in only two U.S. stream systems. The property will be cared for by the Silver Creek Preserve manager and the Idaho Chapter.

ILLINOIS

Elizabeth Lake Marsh (McHenry County). A top priority on the Illinois "natural diversity scorecard" (a report that ranks individual biological elements according to rarity and endangerment), this 120-acre wetland on the shore of Elizabeth Lake takes in an acidic bog, a fen, pond and perennial stream communities, and a calcareous peat mat. These habitats host a wealth of rare plants, including several that are endangered in Illinois: cuckoo flower, round-leaved sundew, purple pitcher plant, smooth white violet, and hooded ladies' tresses. The area will be transferred for management to the McHenry County Conservation District.

IOWA

Charles and Anna Roggman Boreal Slopes—Addition—(Clayton County). Fractures in the limestone of this steep slope create a subterranean cooling system that sustains northern plant species south of their normal range. Beneath a light deciduous forest canopy, mats of Canada yew grow adjacent to cold-air vents along with nationally endangered northern wild monkshood (*Aconitum noveboracense*) and other plants endangered in the state: dwarf scouring-rush, limestone oak fern, bunchberry, twinflower, and *Carex media* (a sedge). The Conservancy has entered into a protection agreement to restrict logging activities on an additional 54 acres, bringing preserve acreage to 120.

KENTUCKY

Brigadoon Preserve (Barren County). Untimbered and unfarmed since the Civil War, this 95-acre gift from Dr. and Mrs. Russell Starr is a wildflower showcase. Species include tway blade, showy orchis, devil's bit, twisted stalk, golden seal, rattlesnake orchid, and putty-root orchid. The land, which supports an old-growth stand of mixed hardwoods, will be managed by Western Kentucky University. The Conservancy has also leased an adjacent 100 acres.

Metropolis Lake (McCracken County). Ringed with swamp tupelo and cypress, the 40-acre lake is habitat for myriad fish species, including five threatened in the state: spotted sunfish, chain pickerel, taillight shiner, cypress minnow, and spotted gar. The surrounding 85 acres is second-growth woodland, a buffer for the lake. Purchased in cooperation with Kentucky's Nature Preserves Commission, which will manage it, the 125-acre area is the first acquired with funds from the state's non-game tax checkoff.

MAINE

Salt Island (Washington County). Purchase of 40 acres—the western half of a forested Machias Bay island—brings permanent protection to an active raptor nesting site. Stone Island, Northwest Head, and Larrabee Heath number among nearby Conservancy projects. The Maine Chapter will manage the island sanctuary, whose name recalls salt works active here in the 19th century.

Woodland Bog (Aroostook County). Limestone bedrock is rare in Maine and rarer under Maine's bogs—so flora suited to such habitat is severely restricted in the state. Conservancy purchase of 114 acres at a registered "state critical area" safeguards a calcareous bog bearing northern white cedars, larches, and seven jeopardized plant species. Among them are *Orchis rotundifolia* (known at only two sites in Maine) and *Valeriana uliginosa* (known at only five). The Maine Chapter will manage the new preserve.

MICHIGAN

Grass Bay Preserve — Addition — (Cheboygan County). A top priority of the Michigan Natural Features Inventory, Grass Bay's diversity of habitats—dunes, grassy swales, cedar swamp, and woodlands—gives rise to a profusion of plant species. Some 250 vascular plants occur here, including 25 orchids and three Great Lakes endemics classified as threatened in the state: Pitcher's thistle, Houghton's goldenrod, and dwarf lake iris. Managed by the Grass Bay stewardship committee, the refuge now stands at 195 acres. The Michigan Chapter and the Michigan Federated Garden Clubs are raising $24,000 for the 50-acre addition.

Lucia K. Tower Nature Preserve—Addition—(Manistee County). A gift to the Conservancy from Mrs. Elizabeth Tower Troy enlarges by three acres this sanctuary of sand dunes and typical dune flora on Lake Michigan's shoreline. Wind action off the lake has carved an ecologically interesting seven-acre gouge or "blowout" in the frontal sand dune of the 31-acre preserve, which is managed by the donor.

MISSOURI

Roaring River State Park (Barry County). Acquired in concert with the Missouri Department of Natural Resources, this dolomite glade/red-cedar savanna harbors a variety of plants characteristic of Missouri's White River glades region but uncommon elsewhere in the state. They include Trelease's larkspur (endemic to the Ozarks of Missouri and Arkansas), Ashe's juniper and *Andrachne phyllanthoides* (both similar to relict species of Texas's Edwards Plateau) and *Palafoxia callosa.* Encompassing the critical northern tip of the now-protected glade, the 58-acre tract will be transferred to the Department of Natural Resources for management by the Division of Parks and Recreation within Roaring River State Park.

MONTANA

Blackfoot River—Additions—(Missoula County). In Big Sky country northwest of Helena, the Blackfoot River cuts a passageway through foothills and lowland forests—habitat for black bears, mountain lions, wolverines, Canada lynxes, elk, beavers, great blue herons, and myriad ducks. It is a key winter migration route for bald and golden eagles. Two conservation easements, donations of Land and Susan Lindbergh and Thomas and Betty Collins, safeguard another 261 acres with one-and-a-third miles of river frontage. The assemblage, now 4,795 acres all told, is monitored by the Big Sky (Montana/Wyoming) Field Office.

Pine Butte Swamp Preserve—Additions—(Teton County). With the addition of a 2,322-acre purchase and lease on 600 acres, the Conservancy controls all of Pine Butte itself: a 500-foot rocky promontory overlooking the 12,445-acre preserve. The new parcels include fen wetland essential to the grizzly bear, a species threatened throughout its range. The Big Sky (Montana/Wyoming) Field Office manages the refuge, which varies from foothill prairie to limber-pine savanna to spruce/fir forest, mountain streams, aspen/willow groves, glacial ponds, and spring-fed swamp. Fund-raising sights are set at $695,000.

NEW JERSEY

William L. Hutcheson Memorial Forest—Addition—(Somerset County). Site of New Jersey's sole virgin forest, the preserve encompasses 182 acres. Rutgers University, Franklin Township, the State of New Jersey, and the Conservancy together acquired a 32-acre addition, which protects a brook that flows into the oak/hickory woodland. Estee Lauder, Inc., contributed $50,000 to the project. The new tract is owned by Franklin Township and leased to Rutgers, while the university owns the remainder of the sanctuary.

NEW MEXICO

Kuenzler's Hedgehog Cactus Site (Chaves County). A one-acre tract of limestone caprock supports a portion of the most significant known population of Kuenzler's hedgehog cactus (*Echinocereus kuenzleri*), a species classified as endangered by the U.S. Fish and Wildlife Service. To protect the site, the Conservancy has acquired a ten-year management lease that will be monitored by the New Mexico Field Office, which is raising $3,125 for the project through its ambitious New Mexico Critical Lands Campaign.

The Sabo Site (San Juan County). A gift from the Public Service Company of New Mexico, the 25-acre parcel hosts the world's only viable population of a plant so rare that the *News* will not print its name. The Conservancy's New Mexico Field Office, which will manage the property, has set a fund-raising goal of $6,875 for the project within its New Mexico Critical Lands Campaign.

NORTH CAROLINA

Antioch Bay (Hoke County). Elliptical, pond-like depressions known as "Carolina bays" once punctuated the coastal plain from southern New Jersey to southern Georgia. Now endangered ecosystems, these sites have been targeted for protection under the Carolina Bays Project of the Conservancy's

Paul E. Moler

National Critical Areas Conservation Program. A recently purchased 62-acre parcel (managed by the North Carolina Nature Conservancy) embraces 80 percent of the projected preserve. Its plant communities harbor two species endangered in the state: awned meadow beauty and sarvis holly.

Dunahoe Bay (Robeson County). The acquisition of 61 acres in three parcels (one a gift of Mr. and Mrs. D. C. McEachern, another a partial gift of Dr. and Mrs. David D. King) safeguards Dunahoe Bay, the only continually flooded clay-based Carolina bay on the inner coastal plain. In addition to pond cypress, black gum, swamp willow, water lilies, and large populations of floating carnivorous bladderworts, the property hosts awned meadow beauties, endangered in the state. It will be managed by the North Carolina Nature Conservancy.

OHIO

Northern Chagrin Reservation Metropark (Cuyahoga County). A three-acre tract overlooking a deep, wooded ravine has been donated by Miss Ruth Adomeit and conveyed to the Cleveland Metropolitan Park District. It is now part of the 1,910-acre Northern Chagrin Reservation, which encompasses extensive beech/maple woods, and bottomland forest and floodplain communities along four miles of the Chagrin River.

OREGON

Agate Desert (Jackson County). Named for the stones that scatter it, this northwestern desert boasts highly specialized flora and vernal pools—small depressions that gather and hold spring rainwater. *Limnanthes floccossa grandiflora*—a protection priority of the Conservancy's Oregon Critical Areas Program and a candidate for federal listing as an endangered plant species—is restricted to the area. (Like other *Limnanthes,* it contains an oil under study for use as a lubricant for machinery and precision instruments.) A newly discovered desert-parsley (*Lomatium*) also is known only from this location; and American

Crocodile Lake National Wildlife Refuge

Species of the ancient order Crocodilia have been around for almost 200 million years, even survived the ice ages; yet they are disappearing at alarming rates. While the alligator seems to be one of the few crocodilians (there are 21) out of trouble, its salt-water cousin, the American crocodile (*Crocodylus acutus*), is barely hanging on. Fifty or so years ago, crocs were plentiful along the mangrove-covered sandbars of what is now Miami Beach and ranged as far north as Palm Beach County. But extensive land development in the 1960's and 1970's has placed the reptile on the official federal list of endangered species.

To help protect the extreme tip of southern Florida—the only U.S. site providing optimum habitat for crocodiles—the Conservancy has acquired 898 acres on northern Key Largo for inclusion in the Crocodile Lake National Wildlife Refuge. The Conservancy's second acquisition for the refuge, the property supports mostly mangrove or open-water lakes, ideal croc homeground. It lies near the reptile's major nesting area, where five nests were recorded in 1983. With this critical addition, the refuge will encompass 1,430 acres, administered by the U.S. Fish and Wildlife Service.

pillwort, endangered in Oregon, occurs here. The Conservancy has negotiated a three-year lease agreement with the City of Medford to manage a critical 28-acre tract, which will be fenced to protect its flora.

Borax Lake Preserve (Harney County). Fed by thermal underground springs, so its waters do not freeze, the ten-acre lake is an important wintering site for waterfowl. But its most significant year-round resident is the endangered, endemic Borax Lake chub. Managed by the Oregon Field Office under the terms of a ten-year lease, the 160-acre property also supports populations of western whiptail and leopard lizards, occurring at the northern end of their ranges. The area was targeted for protection through the Conservancy's Oregon Critical Areas Program.

PENNSYLVANIA

Woodbourne Forest and Wildlife Sanctuary—Addition—(Susquehanna County). Under Conservancy care since 1956, Woodbourne's tract of virgin woods is the largest in eastern Pennsylvania. It features an uncut hemlock and northern hardwood forest, several clear streams, ten-acre Cope Pond, nine salamander species, and an alder swamp. The new ten-acre tract, which safeguards springs feeding into the swamp, completes the assemblage, now 659 acres in all. It is managed by a preserve committee and resident naturalists.

SOUTH CAROLINA

Bamberg County Cowbane Preserve (Bamberg County). A lease agreement with the Westvaco Corporation, Southern Timberlands Division, will enable the Conservancy to protect a 52-acre wet meadow that boasts the world's largest population of Canby's cowbane (*Oxypolis canbyi*). (No more than four populations are known to exist, two in South Carolina.) A candidate for federal listing as an endangered plant, the species numbers several thousand individuals on this new preserve, which will be managed by the Conservancy's South Carolina Field Office. The plant is a protection priority of the Conservancy's Katharine Ordway Endangered Species Conservation Program.

Colleton County Cowbane Preserve (Colleton County). A 32-acre wetland dominated by slash pine, swamp tupelo, cypress, and red maple harbors the state's second largest population of Canby's cowbane (*Oxypolis canbyi*). A project of the Katharine Ordway Endangered Species Conservation Program, the preserve will be managed by the South Carolina Field Office.

WASHINGTON

West Major Creek Preserve (Klickitat County). Orchids abound on this 40-acre site, the gift of an anonymous donor. Species include the clustered lady's slipper (threatened in the state) and phantom, striped coral-root, and calypso orchids. A portion of West Major Creek flows through the Douglas fir-forested preserve, which will be managed by the Conservancy's Washington land steward.

WYOMING

Wallop Conservation Easement (Sheridan County). The Conservancy has been given a conservation easement on 2,150 acres and fee ownership of an adjacent one-acre parcel by the estate of Oliver M. Wallop. Embracing gently sloping foothills of the Powder River Basin's Big Horn Mountains, the property supports scattered remnants of the native bunchgrass *Stipa viridula,* and its upper reaches provide habitat for elk and mule deer. The easement will be monitored by the Montana/Wyoming Field Office.

From time to time, The Nature Conservancy exchanges membership lists with other conservation organizations whose work might also interest you. In this way, we are able to increase the Conservancy's membership at a lower cost than would otherwise be possible. However, if you prefer *not* to receive these mailings from other organizations, please attach the mailing label from this magazine (or copy the label *exactly*) and mail it to:

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For further information, please contact: Alice A. Pinsley, Director of Planned Giving, The Nature Conservancy, 294 Washington Street, Boston, Massachusetts 02108; (617) 338-2103.

NEXT IN THE NEWS:

THE 1983 ANNUAL REPORT

The March/April issue will bring you 1983: an illustrated presentation of the places, programs, and events that made the past year The Nature Conservancy's finest yet.

VOYAGE TO BAJA

See the islands of the Sea of Cortez, nesting seabirds, fish-eating bats, and the breeding grounds of gray whales: join The Nature Conservancy's International Program and Special Expeditions, Inc., (member, World of Lindblad Travel) on a Pacific Ocean voyage to Baja, California, March 17-31, 1984.

The special trip has been arranged to promote a project that is being developed by Mexico's Institute of Biology—with support from the Conservancy and other Mexican and U.S. conservation organizations—to protect ecologically unique islands in the Sea of Cortez. Ship sails (round-trip) from San Diego. Space is limited and available on a first-come, first-served basis; act soon. Price is $2,800 to $3,800 depending on cabin selection. Thirteen percent of the fare is a tax-deductible contribution to the project. For details contact:

Ernesto Barriga-Bonilla
International Program
The Nature Conservancy
1785 Massachusetts Avenue, N.W.
Washington, D.C. 20036

ANNUAL MEETING SET FOR TIDEWATER, VIRGINIA, IN 1984

This past October, more than 500 Conservancy members gathered under blue skies in Tucson, Arizona, for the organization's 33rd Annual Meeting and Conference. Twenty field trips were offered during the five-day meeting—in addition to a morning tour of the Arizona-Sonora Desert Museum and an evening square dance in a cottonwood grove.

The 1984 Annual Meeting is scheduled for Norfolk, Virginia, September 21 through September 23. The Tidewater region of Virginia, which derives its name from the tidal rise and fall of watercourses that empty into the Chesapeake Bay, is rich in history and natural attractions. Trips are planned to the Conservancy's 13-island Virginia Coast Reserve, the Great Dismal Swamp, and Nags Head Woods (a maritime forest lodged among dunes on North Carolina's outer banks).

There will be open meetings of the Conservancy's Board of Governors, training sessions, and a reception hosted by the Virginia Chapter. For a complete registration and information packet on the upcoming meeting (to be mailed in May of 1984), please write: Annual Meeting Coordinator, The Nature Conservancy, 1800 N. Kent Street, Arlington, Virginia 22209.

NEW LIFE MEMBERS

An individual becomes a Life Member of The Nature Conservancy upon contribution of $1,000 for membership dues or for the Land Preservation Fund, Guarantee & Income Fund, or a State Land Preservation Fund. Husbands and wives may hold a joint life membership for a single qualifying contribution.

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NEW CORPORATE ASSOCIATES

A corporation becomes a Corporate Associate of The Nature Conservancy upon contributing between $1,000 and $10,000 annually to the operations of the organization.

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Please join us

Memberships

☐ $1,000 Life ☐ $50 Supporting ☐ $15 Family ☐ $5 Junior (under 18)
☐ $100 Guarantor ☐ $25 Contributing ☐ $10 Subscribing ☐ $1,000 Corporate

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Enclosed is $_____ as membership dues.

Contributions are tax-deductible. Please make checks payable to The Nature Conservancy. Please clip this coupon and use the envelope bound in this issue or mail to: The Nature Conservancy, 1800 N. Kent Street, Arlington, Virginia 22209.

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